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A prospective study to assess the association of vitamin D deficiency and insufficiency with adverse pregnancy outcomes

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Abstract
Background: The complications related to pregnancy and childbirth are the main causes of disability and mortality among the women of reproductive age. Like poor maternal health during pregnancy and lack of care during and after delivery, and also vitamin D deficiency plays an important role in perinatal morbidity. Vitamin D deficiency during pregnancy is common in many parts of the world. There is a very strong statistical relationship between vitamin D deficiency and multiple potential adverse pregnancy outcomes.
Aim and Objectives: The objective of the present study was to determine the levels of vitamin D during pregnancy and assess the association of vitamin D deficiency and insufficiency in pregnant women with adverse pregnancy outcomes.
Materials and Methods: The present study was carried out in the Department of Obstetrics and Gynaecology, TRR Institute of Medical Sciences, Inole (v), Patancheru (M), Sangareddy (Dist.), Telangana, India, consisting of n = 110 subjects, the pregnant women attending the antenatal outpatient department attached to the Medical College. They were tested for serum vitamin D levels.
Results: In this study, 9.1% of the subjects in the study group had normal vitamin D levels, 28.2% study participants were insufficient and 62.7% were deficient in vitamin D levels. Among the total n = 110 subjects, 11.8% participants were observed to be hypertensive (PIH), out of which 30.8% participant women had normal vitamin D levels, 23.1% had insufficient and 46.2% had deficient vitamin D levels. The present study results revealed the presence of low levels of vitamin D amongst the pregnant women. However, the findings of this study showed statistically significant association of vitamin D levels with the incidences of Hypertensive Disorders of Pregnancy, preterm birth, rate of primary Lower Segment Cesarean Section (LSCS), Neonatal Intensive Care Unit (NICU) admissions except for the low birth weight babies.
Conclusion: The current study observations revealed the presence of low levels of vitamin D amongst the pregnant women subjects. Statistical significance was found associated between vitamin D levels and the occurrence of adverse pregnancy outcomes. Hence, vitamin D supplementation could be possible recommendation for all the women who are pregnant and breast feeding.

Keywords: Adverse pregnancy outcomes, insufficiency, vitamin D deficiency

Introduction
Vitamin D deficiency (VDD) is a global health problem with over a billion people worldwide being deficient or insufficient [1, 2]. Pregnant women are especially at high risk, since the prevalence of VDD has been estimated to be up to 50% in this population [3, 4].
Vitamin D insufficiency has been associated with a number of adverse pregnancy outcomes, and has been recognized as a public health concern. The association between vitamin D deficiency and various adverse pregnancy outcomes has been extensively investigated in recent years. The pregnant woman is the only source of vitamin D for the foetus. The main sources of vitamin D for pregnant women are sunlight, fortified dairy products, oily fish and dietary supplements. Vitamin D deficiency during pregnancy has been associated with some adverse neonatal outcomes as well as an increased risk of late pregnancy complications.
A striking difference exists in vitamin D metabolism during pregnancy and fetal development compared to non pregnant women, a point that has been known for at least the past three decades but which has received little attention until recently.
Vitamin D has an increasingly recognised repertoire of non classical actions, such as promoting insulin secretion and its action, immune modulation and lung development.

It therefore has the potential to influence many factors in the development of fetus. The effects of vitamin D on the placento-fetal unit and the mother have been attributed mainly to low calcium effects i.e., the non classical actions of vitamin D [5, 6]. Reports evidenced a large prevalence of vitamin D deficiency/ insufficiency among adolescents and women of reproductive age [7]. They consist around 18% of the global burden of disease in this age-group. Almost 8 million stillbirths and early neonatal deaths are known to occur worldwide each year. Like poor maternal health during pregnancy and lack of care during and after delivery, and also vitamin D deficiency plays an important role in perinatal morbidity. In addition to maternal deaths, more than 50 million women experience maternal health problems annually. Vitamin D deficiency during pregnancy is common in many parts of the world. The statistical relationship between vitamin D deficiency and multiple potential adverse pregnancy outcomes has always been controversial. The role and metabolism of vitamin D in the pregnant state is not very well understood.

The serum vitamin D levels in most of the general population are low. Women with limited exposure to sunlight and those with pigmented skin are at specific high risk. Low vitamin D concentrations have been associated with a wide range of adverse maternal and offspring health outcomes in observational epidemiological studies. Although there exists a dearth of proper wide population based studies, it is considered that giving vitamin D supplementation during pregnancy is not harmful to the patient [8].

Hence, the present study was undertaken to investigate the association of serum 25 (OH) vitamin D levels with adverse pregnancy outcomes.

Objectives

To objective of the present study is to assess the association of vitamin D deficiency and insufficiency in pregnant women with adverse pregnancy outcomes and to assess the levels of vitamin D during pregnancy.

Materials and Methods

The present study was conducted in the Department of Obstetrics and Gynaecology, TRR Institute of Medical Sciences, Inole (v), Patancheru (M), Sangareddy (Dist.), Telangana, India. The present study subjects selected were pregnant women participants attending the antenatal outpatient department attached to the Medical College. The study group consisted of n = 110 subjects presenting to labour room for delivery. They were tested for serum vitamin D levels.

The patients presenting to labour room for delivery were counselled for participation and informed consent was obtained from them before participation. Ethical Committee approval was taken from the Institutional Ethical Committee Board.

The participants were studied for the presence of Pregnancy Induced Hypertension (PIH) before delivery, preterm birth, primary Lower Segment Cesarean Section (LSCS), Low Birth Weight Babies and Neonatal Intensive Care Unit (NICU) admissions. The outcomes as mentioned above were stratified according to their vitamin D levels. In all the patients vitamin D (25 Hydroxy Cholecalciferol) levels were estimated using chemiluminiscence assay. The inclusion and exclusion criteria for the patient participation were as mentioned below:

Inclusion criteria included

Patients presenting in labour

Exclusion criteria

- Patients with systemic and chronic diseases, hematologic disorders, medication and drug abuse.
- Patients with chronic hypertension.
- Patients with overt or pre-existing Diabetes mellitus.
- Patients with malpresentations of fetus and neonates with congenital malformations.
- Patients with twin pregnancy.

Following outcomes were recorded

Primary outcomes

Incidence of vitamin D insufficiency and deficiency in the cohort study stratified according to vitamin D levels.

Secondary outcomes

- Incidence of NICU admissions stratified according to vitamin D levels.
- Incidence of preterm deliveries stratified according to vitamin D levels.
- Incidence of low birth weight neonates stratified according to vitamin D levels.
- Incidence of primary LSCS stratified according to vitamin D levels.
- Incidence of hypertensive disorders of pregnancy stratified according to vitamin D levels.

In all the patients, vitamin D (25 Hydroxy Cholecalciferol) levels were estimated using chemiluminiscence assay and all the tests were done from the same laboratory to reduce the incidence of inter observer variations. The following criteria were used to define and stratify vitamin D levels.

Table 1: Serum vitamin D level

Vitamin D levels	Stratification
>30 ng/ml (>75 nmol/L)	Normal
20-30 ng/ml (50-75 nmol/L)	Insufficiency
<20 ng/ml (<50 nmol/L)	Deficiency

Statistical analysis

The outcome variables were studied against the levels of vitamin D stratified as Normal, insufficiency and deficiency. The data was recorded using patient proforma and compiled using Microsoft Excel. The continuous variables such as age of the patient and vitamin D levels were represented as mean. The nominal outcome variables were represented as percentage. The Chi Square test and the One Way ANOVA test were used to analyse the data. The $p \leq 0.05$ was considered statistically significant.

Results

A total of consecutive n = 110 subjects presenting to labour room for delivery were enrolled in the study. Demography and baseline characteristics are represented in Table 2 and Table 3. The 0data of age-wise distribution of the participant subjects enrolled for the study is presented in Table 2. The youngest patient to participate in the study was 18 years of age and the oldest was 35 years of age. The mean age of participation was 23.27 years.

Table 2: Age-wise distribution

Age (in years)	Number of subjects	Percentage (%)
<20	35	31.8
21-25	50	45.5
26-30	20	18.2
31-35	5	4.5
Total	110	100.0
Mean ± SD	23.27 ± 4.02	

SD- standard deviation

The gestational age-wise distribution (Table 3) of the study population varied from 28 - 42 weeks. The maximum participants (20%) were in the gestational age group of 37 weeks 1 day to 38 weeks.

Table 3: Gestational age-wise distribution

Period of Gestation (wk + days)	Number of subjects	Percentage (%)
27-28	2	1.8
28-29	1	.9
29-30	2	1.8
30-31	1	.9
31-32	8	7.3
32-33	8	7.3
33-34	6	5.5
34-35	13	11.8
35-36	15	13.6
36-37	10	9.1
37-38	22	20.0
38-39	17	15.5
39-40	4	3.6
>40	1	.9
Total	110	100.0

The study population is stratified according to their serum vitamin D levels and presented in the Table 4. Among the total n = 110 subjects in the study group, n = 10 had normal vitamin D levels, n = 69 were vitamin D deficient and n = 31 had insufficient vitamin D levels. It is evident from the data that 28.2% of the participant subjects were insufficient in their serum vitamin D levels, 62.7% were deficient and only 9.1% subjects recorded normal vitamin D levels.

Table 4: Vitamin D level wise distribution

Vitamin D levels	Number of subjects	Percentage (%)
Normal	10	9.1
Insufficiency	31	28.2
Deficiency	69	62.7
Total	110	100.0

The data of the parity wise distribution of the subjects enrolled for the study is shown in Table 5. Out of n = 110 subjects, n = 62 were primigravida and n = 48 were multigravida.

Table 5: Parity of the subjects

Parity	Number of subjects	Percentage
Primigravida	62	56.4
Multigravida	48	43.6
Total	110	100.0

The study population stratified according their mode of delivery is presented in Table 6. Among n = 60 subjects who had preterm deliveries, n = 2 were recorded having normal vitamin D levels, n = 21 subjects had insufficient vitamin D levels and n = 37 were deficient in vitamin D levels. Among n = 50 subjects who had full term deliveries, n = 8 were recorded having normal vitamin D levels, n = 10 subjects had insufficient vitamin D levels, and n = 32 were deficient in vitamin D levels. The calculated *p* value of the association is 0.030 and is statistically significant.

Table 6: Association between vitamin D levels and mode of delivery of the selected subjects

Mode of Delivery	Vitamin D level						Total		*p* value
	Normal		Insufficiency		Deficiency				
	Number	%	Number	%	Number	%	Number	%	
Preterm	2	3.3	21	35.0	37	61.7	60	100.0	0.030
Full term	8	16	10	20.0	32	64.0	50	100.0	
Total	10	9.1	31	28.2	69	62.7	110	100.0	

The study population is stratified according to the incidence of low birth weight neonates and is shown in the Table 7. n = 32 participant subjects, out of n = 110 patients had low birth weight babies and n = 78 subjects had normal birth weight babies.

Table 7: Incidence of low birth weight neonates

Low birth weight	Number of subjects	Percentage
Yes	32	29.1
No	78	70.9
Total	110	100.0

The relationship between vitamin D levels and birth weight of the neonates is shown in Table 8. The mean birth weight of the neonates born to mothers with normal vitamin D level is 2.42kg, mean birth weight of those neonates born to mothers with deficient vitamin D level is 2.10kg and that of those born to the mothers with insufficient levels is 2.03 kg sowing no statistically significant difference.

Table 8: Comparison of vitamin D levels with birth weight

Birth weight (in kg)	Number	Mean ± SD	F value	*p* value
Normal	10	2.42 ± 0.22	3.562	0.032
Insufficiency	31	2.03 ± 0.55		
Deficiency	69	2.10 ± 0.35		
Total	110	2.11 ± 0.42		

SD- standard deviation

The comparison of incidence of low birth weight neonates in the vitamin D sufficient and insufficient group is presented in Table 9. The low birth weight (LBW) neonates were recorded in n= 2

subjects having normal Vitamin D levels and n = 5 participants had LBW neonates in those having insufficient vitamin D levels. The calculated *p* value of the association is 0.777 and is statistically not significant.

Table 9: Comparison of incidence of low birth weight neonates in the vitamin D sufficient and insufficient groups

Low Birth Weight	Vitamin D levels				Total		*p* value
	Normal		Insufficient				
	Number	(%)	Number	(%)	Number	(%)	
Yes	2	28.6	5	71.4	7	100.0	0.777
No	8	23.5	26	76.5	34	100.0	
Total	10	24.4	31	75.6	41	100.0	

% percentage

The comparison of incidence of low birth weight neonates in the vitamin D sufficient and deficient groups is shown in Table 10. The LBW neonates were recorded in n = 2 subjects having normal vitamin D levels and n = 25 women participants with deficient vitamin D levels had LBW noenates. The calculated *p* value of the association is 0.312 and is statistically not significant.

Table 10: Comparison of incidence of low birth weight neonates in the vitamin D sufficient and deficient groups

Low Birth Weight	Vitamin D levels				Total		*p* value
	Normal		Deficiency				
	Number	(%)	Number	(%)	Number	(%)	
Yes	2	7.4	25	92.6	27	100.0	0.312
No	8	15.4	44	84.6	52	100.0	
Total	10	12.7	69	87.3	79	100.0	

The study population is stratified according to the NICU admissions and is shown in the Table 11. Among the total n = 110 subject participants, n = 38 neonates had NICU admission and n = 72 neonates were given mother side.

Table 11: Incidence of NICU admissions

NICU admissions	Number of subjects	Percentage
Yes	38	34.5
No	72	65.5
Total	110	100.0

The incidence of NICU admissions in vitamin D normal and insufficient group is presented in Table 12. No NICU admissions were recorded in subjects having normal vitamin D levels however, 16 neonates had NICU admissions in vitamin D level insufficiency group. The calculated *p* value of the association is 0.004 and is statistically significant.

Table 12: Comparison of incidence of NICU admissions in vitamin D sufficient and insufficient groups

NICU admissions	Vitamin D levels				Total		p value
	Normal		Insufficiency				
	Number	(%)	Number	(%)	Number	(%)	
Yes	0	0.0	16	100.0	16	100.0	0.004
No	10	40.0	15	60.0	25	100.0	
Total	10	24.4	31	75.6	41	100.0	

The comparison of the incidence of NICU admission in the vitamin D sufficient and deficient group is shown in Table 13. No infant of study group subject with normal vitamin D level had NICU admission and infants of n = 22 subjects with deficient vitamin D levels had NICU admissions. The calculated *p* value of the association is 0.036 which is statistically significant.

Table 13: Comparison of incidence of NICU admissions in vitamin D sufficient and deficient group

NICU admissions	Vitamin D levels				Total		p value
	Normal		Deficiency				
	Number	(%)	Number	(%)	Number	(%)	
Yes	0	0.0	22	100.0	22	100.0	0.036
No	10	17.5	47	82.5	57	100.0	
Total	10	12.7	69	87.3	79	100.0	

The study population is stratified according to the presence of pregnancy induced hypertension presented in Table 14. A total of n = 13 subjects (11.8%) out of n = 110 subjects had pregnancy induced hypertention (PIH) and n = 97 subjects are recorded normotensive.

Table 14: Pregnancy induced hypertension

Hypertension	Number of subjects	Percentage
Yes	13	11.8
No	97	88.2
Total	110	100.0

Table 15: Association between vitamin D levels and Pregnancy Induced Hyptertension

Hypertension	Vitamin D levels						Total		p value
	Normal		Insufficiency		Deficiency				
	Number	(%)	Number	(%)	Number	(%)	Number	(%)	
Yes	4	30.8	3	23.1	6	46.2	13	100.0	0.014
No	6	6.2	28	28.9	63	64.9	97	100.0	
Total	10	9.1	31	28.2	69	62.7	110	100.0	

The comparison of the incidence of pregnancy induced hypertension in the vitamin D sufficient and insufficient group is shown in Table 16. Among the selected subjects n = 4 participants with normal vitamin D levels had PIH and n = 3 subjects with insufficient vitamin D level had PIH. The calculated *p* value of the association is 0.027 and is statistically significant.

Table 16: Comparison of incidence of pregnancy induced hypertension and vitamin D sufficient and insufficient groups

Hypertension	Vitamin D levels				Total		*p* value
	Normal		Insufficiency				
	Number	(%)	Number	(%)	Number	(%)	
Yes	4	57.14	3	42.86	7	100.0	0.027
No	6	17.5	28	82.35	34	100.0	
Total	10	24.4	31	75.60	41	100.0	

The comparison of the incidence of pregnancy induced hypertension in the vitamin D sufficient and deficient group is shown in Table 17. The n = 4 subjects with normal vitamin D level had PIH and n = 6 participants with deficient vitamin D level had PIH. The calculated *p* value of the association is 0.005 and is statistically significant.

Table 17: Comparison of incidence of pregnancy induced hypertension in vitamin D sufficient and deficient group

Hypertension	Vitamin D levels				Total		*p* value
	Normal		Deficiency				
	Number	(%)	Number	(%)	Number	(%)	
Yes	4	44.44	6	66.67	10	100.0	0.005
No	6	8.57	63	90.00	70	100.0	
Total	10	12.70	69	87.30	79	100.0	

The study population stratified according to the incidence of primary LSCS is presented in Table 18. Among the total of n = 110 subjects, n = 16 participants had undergone primary LSCS and n = 94 subjects had vaginal deliveries.

Table 18: Incidence of primary Lower Segment cesarean Section

Primary LSCS	Number of subjects	Percentage
Yes	16	14.5
No	94	85.5
Total	110	100.0

LSCS- Lower Segment cesarean Section

The comparison of the incidence of primary LSCS in the vitamin D sufficient and insufficient group is shown in Table 19. The n = 5 subjects with normal vitamin D levels had primary LSCS and n = 5 subjects with insufficient vitamin D levels had primary LSCS. The calculated *p* value of the association is 0.030 and is statistically significant.

Table 19: Comparison of incidence of primary LSCS in the vitamin D sufficient and insufficient groups

Primary LSCS	Vitamin D levels				Total		*p* value
	Normal		Insufficiency				
	Number	(%)	Number	(%)	Number	(%)	
Yes	5	50.00	5	50.00	10	100.0	0.030
No	5	16.13	26	83.87	31	100.0	
Total	10	24.39	31	75.61	41	100.0	

The comparison of incidence of primary LSCS in the vitamin D sufficient and deficient group is shown in Table 20. The subjects n = 5 with normal vitamin D levels had primary LSCS and n = 6 subjects with deficient vitamin D levels had primary LSCS. The calculated *p* value of the association is 0.019 and is statistically significant.

Table 20: Comparison of incidence of primary LSCS in the vitamin D sufficient and deficient groups

Primary LSCS	Vitamin D levels				Total		*p* value
	Normal		Deficiency				
	Number	(%)	Number	(%)	Number	(%)	
Yes	5	45.45	6	54.55	11	100.0	0.019
No	5	7.35	63	92.65	68	100.0	
Total	10	12.60	69	87.40	79	100.0	

Discussion

Vitamin D insufficiency and deficiency is associated with several adverse health complications, including pregnancy outcomes and is recognised as a public health concern. The participants were studied for presence of pregnancy induced hypertension, preterm deliveries, primary LSCS, NICU admissions and low birth weight neonates. The outcomes were stratified according to their Vitamin D levels.

Vitamin D deficiency prevails in epidemic proportions all over the Indian subcontinent, with a prevalence of 70 - 100% in the general population. In India, widely consumed food items such as dairy products are rarely fortified with vitamin D. Indian socio religious and cultural practices do not facilitate adequate sun exposure, thereby negating potential benefits of plentiful sunshine. Consequently, subclinical vitamin D deficiency is highly prevalent in both urban and rural settings, and across all socioeconomic and geographic strata. Sahu, *et al.* [8] studied the prevelance of vitamin D deficiency in rural girls and pregnant women despite abundant sunshine in northern India and reported a high prevalence of vitamin D deficiency among pregnant women and adolescent girls from rural Indian community [8]. The studies from South India in women of reproductive age and postmenopausal women revealed that 76% of reproductive age women and 70% of the post-menopausal women were vitamin D deficient. The studies from Lucknow (Central India) have also shown that 84.3% urban women and 83.6% rural women suffered from vitamin D deficiency. The probable reasons of the wide spread vitamin D deficiency in Indians could be because of low dietary vitamin D intake, high fiber and phytate intake that depletes vitamin D levels, reduced exposure to sunlight, pollution or reduced exposure of skin to sun light because of cultural and traditional habits like “burkha” or “parda”.

In this study on n = 110 consecutive pregnant ladies, high incidence of vitamin D insufficiency and deficiency was observed. Among n = 110 subjects, n = 10 (9.1%) participants in this study group had normal vitamin D levels, n = 69 (62.7%) were deficient in vitamin D and n = 31 were insufficient in vitamin D levels. It is evident that despite improvements in the socio-economic demography of the Indian population, there is still widespread prevalence of vitamin D insufficiency and deficiency. The results of serum vitamin D levels in this study are consistent with the findings of Sahu *et al*. [9]

In this study, the association of vitamin D levels with the incidence of hypertension in pregnancy was assessed. A total of n = 13 (11.8%) subjects out of n = 110 had hypertensive disorders of pregnancy. Among them, 4/13 had normal vitamin D levels, 6/13 had vitamin D deficiency and 3/13 had vitamin D insufficiency. However, n = 97 among n = 110 subjects did not have any hypertensive disorders of pregnancy. Out of n = 97 subjects, n = 6 subjects had normal vitamin D levels, n = 63 had deficiency of vitamin D and n = 28 had insufficient vitamin D levels. Statistical analysis revealed *p* values of 0.005 and 0.027 respectively, on comparing the incidence of hypertension in pregnancy women with normal vitamin D level to those with vitamin D deficiency and insufficiency respectively. Thus it is evident that there is statistically significant difference in the incidence of hypertensive disorders of pregnancy in all the three groups i.e. vitamin D normal, insufficient and deficient groups.

The national incidence of hypertensive disorders of pregnancy is 15.2% in India. The present study results are comparable to the national data (11.8%).

In this study, a total of n = 16 subjects, out of n = 110 subjects had primary LSCS of which 5/16 had normal vitamin D levels, 5/16 were insufficient in vitamin D and 6/16 were deficient in vitamin D. Statistical analysis data revealed *p* values of 0.019 and 0.030 respectively on comparing the incidence of primary LSCS in patients with normal vitamin D level to those with vitamin D deficiency and insufficiency respectively. Thus it is evident that there is statistically significant difference in the incidence of primary LSCS in all the three groups i.e., vitamin D normal, insufficient, and deficient groups. Thus, there is at present insufficient evidence about the association of vitamin D deficiency during pregnancy and the risk of caesarean section. Vitamin D supplementation with the aim of reducing the incidence of caesarean section is currently not indicated.

There were a total of n = 38 NICU admissions of which none had normal vitamin D level, n = 22 were deficient and n = 16 were insufficient in vitamin D levels. Statistical analysis revealed *p* values of 0.036 and 0.004 respectively on comparing the incidence of NICU admissions in subjects with normal vitamin D level to those with vitamin D deficiency and insufficiency respectively. Thus it is evident that there is statistically significant difference in the incidence of NICU admissions in all the three groups i.e., vitamin D normal insufficient and deficient groups.

Out of the total n = 110 subjects, n = 32 subjects had low birth weight babies, the subjects of 2 babies had normal vitamin D levels, the subjects of 5 babies had insufficient vitamin D levels and the subjects of 25 babies had vitamin D deficiency. Statistical analysis revealed *p* values of 0.312 and 0.777 respectively on comparing the incidence of low birth weight neonates in subjects with normal vitamin D level to those with vitamin D deficiency and insufficiency respectively. Thus it is evident that there is no statistically significant difference in the incidence of low birth weight neonates in all the three groups i.e., vitamin D normal, insufficient and deficient groups.

The values obtained after comparing the incidences of the individual adverse pregnancy outcomes, in patients with primary LSCS, preterm birth, PIH and NICU admissions amongst those with normal, insufficient and deficient vitamin D levels, showed significant results whereas, the low birth weight babies showed insignificant results.

Natasha Nassar *et al*. [10] undertook a systematic review to assess normative levels of vitamin D in early pregnancy and association with subsequent pregnancy outcomes. This review showed the lack of information regarding vitamin D levels in pregnancy and, more importantly, it showed that there are no clear definitions of what levels constitute vitamin D deficiency, insufficiency, and sufficiency.

Gupta *et al*. [11] reported that preeclampsia is indeed associated with lower vitamin D levels, and that its pathophysiology involves vitamin D and calcium metabolism. Thus, for neonates

to be born with adult-normal 25(OH)D concentrations, their mothers must be vitamin D- sufficient.

Passage of 25(OH)D from mother to fetus could reduce maternal levels, especially if the mother is deficient in vitamin D. The observational studies done so far have shown either no change or a modest decline in maternal 25(OH)D concentrations during pregnancy. No studies have addressed whether the ideal level of 25(OH)D during pregnancy should differ from the level considered sufficient for non pregnant adults.

Indian data on the studies of vitamin D in pregnancy is extremely lacking. Whatever study exists, the participating population is very small, thus indicating need for studies with higher population.

Conclusion

In this study, the presence of low levels of vitamin D amongst the pregnant ladies was observed. The incidence of vitamin D insufficiency and deficiency calculated in the present study is comparable to that in the general population as computed in the Indian studies. However, it is found statistically significant association of vitamin D levels with the incidence of hypertensive disorders of pregnancy, preterm birth, rate of primary LSCS, NICU admissions except for the low birth babies.

The recent study results evidences suggests that vitamin D supplementation could be of value in reducing the risk of pregnancy complications. The supplementation of vitamin D in pregnancy has been clearly shown to be safe and thus can be recommended. However, high quality clinical studies with high population data are still needed on this subject.

The statistical significance could be elicited between vitamin D levels and the occurrence of adverse pregnancy outcomes. The treatment of vitamin D deficient women with vitamin D supplementation is safe and is recommended for all women who are pregnant or breast feeding.

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